Larvae of
Calyptra minuticornis,
Eudocima fullonia and
E. salaminia
on Stephania japonica

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Planning and Organization Meetings

A quarterly meeting is scheduled in order to plan club activities and the magazine. See BOIC Programme.

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Aims of Organization

- To establish a network of people growing butterfly host plants;
- To hold information meetings about invertebrates;
- To organize excursions around the theme of invertebrates e.g. butterflies, native bees, ants, dragonflies, beetles, freshwater habitats, and others;
- To promote the conservation of the invertebrate habitat;
- To promote the keeping of invertebrates as alternative pets;
- To promote research into invertebrates;
- To encourage the construction of invertebrate friendly habitats in urban areas.

Magazine Deadlines

If you want to submit an item for publication the following deadlines apply:
March issue – February 1st June issue – May 1st
September issue – August 1st December issue – November 1st

Cover Painting

Larvae of *Calyptra minuticornis, Eudocima fullonia* and *E. salaminia* on *Stephania japonica* – painting by Lois Hughes

From the President

Lots of interesting information and images have been packed into this edition of our magazine and we are again grateful for the enormous amount of time and attention to detail evidenced in each article. I thank Michelle Clark, Lois Hughes, Wesley Jenkinson, Glenn Leiper, Geoff Monteith, John Moss, Phil Ochse, Hilton Selvey, Robert Whyte, Jennifer Singfield, Malcolm Tattersall and the various photographers.

For the sixty-seventh time Daphne has assembled articles and images, consulted with specialists, worked on format and prepared the final copy for printing. We thank Phil Ochse for his enthusiastic support in helping our transition to a new printing company. I am sure you have noticed the positive results. Congratulations to Jennifer Singfield and her team for planning and conducting a very successful trivia night on October 6th last. We thank them for their willing contributions.

I frequently think of the many members of our club who live far from our "base" in the Brisbane area and of the fact that opportunities for interaction are limited. If you are on our membership directory, then you may readily determine if there are other members close to you and may elect to contact them. No matter where you live, there are opportunities for observing invertebrates in action, taking some photographs and sending them to us with a few notes or questions.

Those of the older generations will remember Box Brownies, 35 mm colour slides and the progression to colour prints. You will also remember the need to be conscious of the cost of each click of the shutter as we used up expensive film. What a revolution we have had with the development of digital cameras and the ability to take hundreds of shots in a short session. In this edition Rob Whyte encourages you to "shoot" spiders while Malcolm Tattersall demystifies those pixels and also encourages you to start shooting! Best wishes *Ross*

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Fruit-piercing Moths – Night Raiders! - *Lois Hughes and John Moss*

On the Hughes' property at Mt Cotton, in the Redlands, grows a common menisperm vine with heart-shaped peltate mid-green leaves, *Stephania japonica* var. *discolor* or Tape Vine. It twines its way gracefully through the undergrowth and trails across the ground in the moist areas along the creek. It bears clusters of insignificant greenish-yellow flowers followed progressively by bunches of attractive, at first green, then yellow and finally red berries (approximately 6mm in diameter).

In the shadier areas, a less common related paler-leaved vine, *Echinostephia aculeata* or Prickly Tape Vine can also be found. The "prickles" on stems and leaf petioles are quite soft and innocuous. In addition, a much larger relative is also found in the more pristine areas. This rather woody and quite hairy large-leaved vine is *Legnephora moorei* or Round-leaved Vine and has tiny pale-yellow flowers followed by reddish to purplish-black fruit up to a centimetre in diameter (Leiper *et al*. 2008).

What these vines have in common is the ability to support large numbers of several species of economically important but very attractive fruit-piercing catocaline moths in the family Noctuidae. Knowing this, and having seen many of the moths blunder into the house at night (mesmerised by the house lights), Lois set about inspecting the vines regularly, looking for evidence of larval chewings as well as any eggs, larvae or pupae that might be present. She was interested to learn more about their life history as they progressed from egg to adult.

In December 2010, Lois was delighted to discover a huge, stunningly-patterned, "fat", black caterpillar resting on one of the *Stephania* vines which had "escaped" from the undergrowth and twined along a fence. The following morning an equally large, slightly less colourful, dark grey caterpillar was found on the same vine, well camouflaged against a grey wooden fencepost (see images).These were retained for study and photography. At that stage the larvae were thought to be *Othreis* (now *Eudocima*) species, although which one(s) was not then known for certain.

With great astonishment, before the week was out, yet another different caterpillar was found on the same vine. This one was somewhat different – slender-shaped, greenish-black and with an orange head. Like the other two it was given its own container with sufficient hostplant to keep it well fed until it was ready to pupate, which it did once it reached 50mm in length. It actually pupated between layers of tissue lining the container, suggesting that its natural pupation site may be among fallen leaves on the forest floor. The colouration was predominantly black with the final instar having dark green dorsal stripes and a yellowish-orange head (see images). At a guess we thought that it may have been the rather drably-coloured but interestingly-shaped moth *Calyptra minuticornis* (see images). Eventually, after the adult emerged, we were to be proven correct.

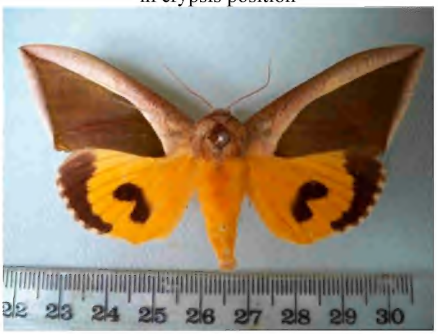
Final instar larva of *Eudocima fullonia*, fruit piercing moth in warning pose

E. fullonia pupa in leaf shelter

Pupa of *E. fullonia*

Fruit-piercing moth, *E. fullonia,* in crypsis position

Set specimen of *E. fullonia*,



Set specimen of *E. salaminia*

With respect to the two *Eudocima* larvae, it was fascinating to observe the strange contortions that the caterpillars positioned themselves in. Coupled with cryptic colours and false eye spots, their behaviour was apparently designed to confuse or even frighten any predator. So much so that they hardly looked like fat, juicy, easy meals for raptor, rat or reptile – their disguise was near perfect.

These two devoured all parts of the leaves on which they fed, leaving only the petiole (stalk). They were approximately 80mm long at maturity, when they commenced building their pupal shelters by stitching together (with silken threads) their hostplant leaves and anchored them to the walls of the containers. John separately found a couple of these *Stephania* leaf shelters, containing both prepupae and pupae (see images) in the nearby West Mt Cotton council reserve, suggesting that the larvae may have a natural preference for using their hostplant leaves for pupation (see images).

Final instar larva of *E. salaminia* on *Stephania japonica*

Adult *E. salaminia* moth in crypsis pose

Leaves of *Stephania japonica* hiding *Eudocima* moth larval shelter

Eudocima moth *Stephania* leaf larval shelter

Head of fruit-piercing moth, *E. fullonia,* showing antennae, large palps and stylet-tipped proboscis

As suspected the two moths on emergence were shown to be the attractive species *Eudocima fullonia* (was *Othreis fullonia*) and *E. salaminia* respectively (see images).

Ironically (and somewhat sadly), when it comes to damaging orchardists' fruit crops, these two are considered to be among the worst offenders as far as adult fruit-piercing moths are concerned. Where they occur in large numbers (they are efficient breeders and migrants) they can cause significant damage to mature fruit particularly soft skinned fruit in north Queensland and the Northern Territory. A wide variety of fruits including mango, banana, guava, fig, papaya, kiwifruit, stone and citrus are affected in the nocturnal depredations of these raiders of the night. The moths have a stiff proboscis with a sharp tip which is easily inserted into the fruit (see images). This allows them to suck out the fruit juice and even soft pulp. As if that were not enough, the initial damage allows the entry of bacterial and fungal pathogens often resulting in fruit drop.

Another much larger but rarer fruit moth, *Phyllodes imperialis,* the stunning Imperial Fruit Moth (sometimes called the "Pink Underwing Moth"), does not have the lancet tipped proboscis and is not considered to be a pest species as it only feeds on fruit that has already been damaged .

Larva of *Phyllodes imperialis*,
Imperial Fruit Moth

Imperial Fruit Moth, *Phyllodes imperialis*,
in crypsis pose

Phyllodes imperialis
exposing pink markings on hindwings

Set specimen of *Phyllodes imperialis,*
Imperial Fruit Moth or Pink Underwing Moth

The larvae of the northern form feed on several menisperm vines in north Queensland where it is not uncommon, whereas the southern form (SEQ and northern NSW) only appears to feed on the uncommon menisperm vine *Carronia multisepalea,* which only occurs in pristine, mostly montane, subtropical and warm temperate rainforests. This species has been the subject of an article in the monochrome BOIC newsletter (as it was) in the past but certainly warrants a *Metamorphosis Australia* update, on its own, with full colour depiction. Its larva is even more bizarre than the others. We could not do it full justice here (see images).

Attached beneath one of the *Stephania* leaves was a pupa in a greenish silk cocoon (see image). We were unsure if the larva had used this plant as its host or if it was just a convenient place to pupate. The moth that emerged was identified as *Chrysodeixis argentifera* (same image as above) a crop pest noctuid that Common (1990) does not record from menisperms. However, he does state that the moth does have a preference for "low growing" host plants, which of course is the habit of *Stephania*. It would be interesting to follow this up.

Adult (L) and cocoon (R) of *Chrysodeixis argentifera* on *Stephania japonica* leaf

Early instar larvae if *Calyptra minuticornis* (above) and *Plusiodonta coelonata*

Early instar larva of *Calyptra minuticornis*

Late instar larva of *Calyptra minuticornis* on *Stephania japonica*

Set specimens of fruit-piercing Stephania moth *Calyptra minuticornis*

Set specimens of *Plusiodonta coelonata* female left - male right

We have repeated some of the above observations in April and May of this year (2012). As well as seeing the original three species (as above), another smaller species of catocaline moth (*Plusiodonta coelonata*) has appeared, again utilising *Stephania* as its hostplant. This has pretty black larvae with yellow spots and head capsule and the attractive adult moth has wing patches of golden bronze (see images). At Pottsville NSW, in March/April 2000, John found it on Barb Wire Vine, *Smilax australis*, a monocotyledon, with several specimens maturing to adults. This is a new and unexpected (previously unpublished) record as a hostplant for a catocaline moth.

Photos John Moss

References:

Common, I. F. B., 1990. *Moths of Australia.* Melbourne University Press.

Leiper, G. *et al*, 2008. *Mangroves to Mountains.* Revised edition. Logan River Branch, Society for Growing Australian Plants (Qld Region) Inc., Brisbane

PLANT PROFILE

Capparis canescens - *Glenn Leiper*

Family: Capparaceae

Common Name: Wild Pomegranate, Wild Orange or Bumble Bush

Distribution: Predominantly eastern Queensland, from Cape York to the NSW border, with one record from northern NSW near Ashford.

Conservation Status: Common species throughout its distribution in inland Queensland, however its status in NSW is classified as Endangered. It is known in NSW from a handful of specimens near Ashford, where some were destroyed for roadwork.

Description:
A small tree to about 4 metres, with very short dense hairs and sometimes thorny branches. These thorns are often in pairs, are brown and curved to about 5 mm long. The trunk sometimes has rose-like spines.

Wild Pomegranate, Wild Orange or Bumble Bush

Characteristic mature barked trunk

Bark: The bark is thick, brown and furrowed on older plants, while smaller branches are smooth.

Foliage, showing flower buds on long peduncles

Leaves: The ovate stiff leathery leaves are alternate on the stems, and grow from 4.5 cm to 10 cm long and from 2.5 cm to 6 cm wide. The leaf petiole is from 1.75 cm to 4 cm long.

Flowers: The showy creamy-white flowers (about 5 cm diameter) are usually produced from the leaf axils, with up to 4 together, on peduncles (stems) from 3 cm to 9.5 cm long. Each flower has 4 creamy-white or pink-tinged petals approximately 3 cm long, and usually hairy. In typical Capparis style, the numerous stamens are prominent and long compared to the petals. Flower buds are 1.7 cm to 2.3 cm long and often conspicuously 4-ridged.

Fruit: The green fruits are more or less spherical, from 2.5 cm to 7.5 cm diameter, on stalks from 6 to 9 cm long.

Fresh flower

A slightly collapsed flower showing the now limp stamens

Flowering period: mainly summer, but often extending into autumn.

Habitat: open eucalypt forest on flats, hills and ridges. Can be found growing on a range of soils that include sand, loam, gravelly soils and light clay-based soils.

Traditional indigenous uses: edible flesh in the fruit and the flower buds are also edible.

Wildlife uses:

1. Cockatoos extract wood-boring caterpillars from the branches.
2. Termites readily attack the timber.
3. Host plant for the Australian Caper Gull (*Cepora perimale*), Caper White (*Belenois java teutonia*), Chalky Pearl-white (*Elodina parthia*), Narrow-winged Pearl-white (*E. padusa*), Southern Pearl-white (*E. angulipennis*).

Photos Ross Kendall

References:

Eddie, Craig, 2007. "Field Guide to Trees and Shrubs of Eastern Queensland and Oil and Gas Fields", published by Santos Ltd.

Stanley, T. D. and Ross, E. M., 1983. "Flora of South-eastern Queensland" Volume 1, Published by the Queensland Government.

Moss, J.T., 2010. Butterfly Host Plants of south-east Queensland and northern New South Wales. 3rd edition, BOIC.

Aphids – *Hilton Selvey*

There are many species of aphids in the family Aphididae. All are soft-bodied insects, which vary in size from 2 to 5mm. They, like all insects, have compound eyes and segmented antennae. Their food is obtained by piercing leaves and stems and sucking the sap. They do this through sucking stylets enclosed in a sheath called a rostrum (Fig.2). In this way they do great harm to many species of plants. They may also transmit viruses, which can infect beans, wheat and passionfruit along with other plant species. Different species of aphids have different colours, which range from pale green to yellow and black, there being a lot of colour variation within species (Figs 3-6). Usually colour is not a good identifying feature on its own.

The milkweed aphids I studied are called *Aphis nerii*.

Aphids are viviparous and their young are produced by parthenogenesis. The young are all females and sometimes they have young already developed internally before being born themselves. At the end of the summer some males are produced that mate with the females who then lay eggs that only hatch in the spring. This accounts for the sudden appearance of aphids as happened on milkweed growing in my garden.

Many of the aphids I studied were winged (Fig.1). These aphids are produced if the food source is overcrowded or food becomes scarce. They fly off looking for new sources of food and to start new colonies.

The appearance of an aphid is very strange with the two spikes, called cornicles, at the rear of the body (Fig.3). The cornicles secrete a waxy substance, which is said to be protective. The woolly aphid's cornicles secrete masses of a white fluffy substance that can completely cover the insects and the stems of the apple tree where they are feeding. These aphids belong to a subfamily Pemphiginae genus *Eriosoma.*

Ants often attend aphids as they eat the honeydew produced from the aphid's cauda, an opening just above the anus (Figs 3 and 6). The ants sometimes carry aphids to a source of food, as happened to my orange tree. To get rid of the aphids I would hose them off but it wouldn't be long before they returned. The only way I could prevent this was to surround the stem of the tree with ant poison.

There are several species of aphid parasitoid present in Australia. It's likely that these parasitoids are the most important control agents although ladybirds, ladybird larvae (Fig.7), green lacewing larvae (Fig.8), hover fly larvae and tiny wasps that lay their eggs inside the body of an aphid do have some effect. The natural enemies of aphids must be fairly effective otherwise there would not be any reason to reproduce in such quantity.

Acknowledgement: Dr. David Britton for identifying the species of aphid studied and Drs. Christine Lambkin and Sarah Mansfield for helpful comments. Also Enid Selvey who used her computer skills to produce my photographs. Photos Hilton Selvey

Fig. 1 Winged aphid

Fig. 2 Rostrum

Fig. 3 Yellow form

Fig. 4 Green form

Fig. 5 Black form–dorsal view

Fig. 6 Black form- lateral view

Fig. 7 Ladybird larva eating aphids

Fig. 8 Green Lacewing larva

Life history notes on the Dusky Knight, *Ypthima arctous* - (Fabricius, 1775) Lepidoptera: Nymphalidae - *Wesley Jenkinson*

This is another of Australia's common butterfly species that has very limited published biological detail.

Dusky Knight (*Ypthima arctous*)

The Dusky Knight (*Ypthima arctous*), also previously known as the Dingy Ring, is encountered along much of the eastern coastal and sub-coastal districts from north-eastern Queensland southward into Victoria and also the Northern Territory. Ross Kendall collected a specimen 25km northeast of Hughenden during September 2011, some hundreds of kilometres west of its previously reported range in Queensland (Kendall, 2011).

This small to medium sized species can be very seasonally common north of Brisbane where it chiefly favours woodlands and open forests with a grassy understorey. The adults are located flying in full or dappled sunlight usually within a couple of metres from ground level. They have a similar 'bobby' flight pattern typical of the ringlet's (*Hypocysta* genus) with which they can be confused. While basking and feeding at flowers their wings are periodically opened and closed, revealing the upper-side wing pattern. Both sexes frequently settle on grasses and low-growing plants and feed from a variety of small native and exotic flowers. Flight is often slow, however once disturbed they can fly quite rapidly, being difficult to follow through understorey vegetation.

The sexes are quite similar in appearance. In comparison with the males, the females wing termen (outer margin) is more rounded, the abdomen is slightly shorter and wider. Overall, females are generally larger in size.

The average wingspan for those pictured is males 25mm and 31mm for the females.

Ypthima arctous (Dusky Knight)
Images left to right: male, female, male underside, female underside

On a recent trip during April 2012 to the Perry River west of Bundaberg, a female was collected and kept in captivity. She laid several eggs and was then released. These eggs were kept for life history studies. Subsequently, larvae were successfully raised on native Green Couch Grass (*Cynodon dactylon*) with full sized male and female adults emerging. The native host grasses appear to be largely unknown, however larvae have been raised successfully on Blady Grass (*Imperata cylindrica*) and Kangaroo Grass (*Themeda triandra*) (Braby, 2000; Moss, 2010) as well as Queensland Blue Couch (*Digitaria didactyla*) (Braby, 2000).

Freshly laid eggs were smooth and bright green, fading to pale yellowish green, slightly off spherical and approximately 1mm high x 1mm wide.

Freshly laid egg of *Y. arctous*

1st instar larva

2nd instar larva

3rd instar larva

4th instar larva

4th instar larva showing bifid anal segment

5th instar larva

In captivity the first instars emerged by 8.00am and consumed their eggshells shortly afterwards. The larvae were observed feeding solitarily during daylight hours and resting on either side of the leaves of the utilised host plant. They were very slow moving and fed from the outer edge of the leaf. Ecdysis was very difficult to detect between the early instars due to their slow progression and similarity. It appeared the larvae completed five instars (as pictured) and the final larval instars attained a length of 23mm.

Pupa lateral, dorsal and ventral view

The attractive pupae were attached by silk to grass stems, hanging by the cremaster with the head suspended down. They were green in colour and measured 12mm in length.

The total time from egg to adult was about three months, with egg duration of 6 days, larval duration 67 days and pupal duration of 16 days.

I don't have any records of this species within the boundary of the new Scenic Rim Regional Shire south of Brisbane. However given its general distribution range it should be present in this region in suitable habitat.

Photos Wesley Jenkinson

References:

Braby, M.F., 2000. Butterflies of Australia – Their Identification, Biology and Distribution. vol 2. CSIRO Publishing.

Kendall, R., 2000. A new location for the Dusky Knight, *Ypthima arctous* (Fabricius, 1775) Lepidoptera: Nymphalidae : Satyrinae. *Metamorphosis Australia*: Magazine of the Butterfly and Other Invertebrates Club **63**:33.

Moss, J.T., 2010. Butterfly Host Plants of South-east Queensland and Northern New South Wales. 3rd edition, BOIC.

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Social Behavioural Studies of *Laxta granicollis* - *Michelle Clark*

Does the *Laxta granicollis,* Australian native cockroach, express social behaviour and can therefore be considered a social organism?

Juvenile *Laxta granicollis* with the mother

Abstract

Knowledge of the social behaviour of cockroaches can be used for developing more effective controls for those which are considered pests, and can also give insight into how cockroaches came to play a large role

in the cuisine and medicine of some traditional cultures. The research question for this essay is: Does the *Laxta granicollis,* Australian native cockroach, express social behaviour and can therefore be considered a social organism?

Throughout this essay the social capabilities of *Laxta granicollis* were explored; firstly through observing their movements when they were initially introduced into a new environment, and secondly observing their movements over the duration of two weeks. Preliminary observations, which involved filming the cockroaches daily, found the cockroaches to be nocturnal and in particular were only active for a few hours after dusk. In the formal observations, it was recorded how frequently they found refuge together when they were not active. This was used to indicate the strength of their social tendencies.

Although in the first study the cockroaches found refuge and may have grouped together on their initial introduction to an environment, this may not have been due to social tendencies but due to random outcomes as they sought the safety of a harborage. In the second study, the cockroaches were given time to adjust to their new environment and their behaviour observed over many days. This also allowed the cockroaches time to possibly produce any aggregation pheromones, a hormone which is found in other cockroach types, which encourages social behaviour.

From these observational studies, the conclusion was drawn that *Laxta granicollis* is a social organism as it displayed various aspects of social behaviour forming affliative aggregations.

Introduction

Cockroaches are insects, Order: Blattodea, (Roth, 1991: 320) acting as detritivores, where dead plant material is their main diet (Gordon, 1996: 45), although they can utilise an extensive range of substances for nourishment (Hahn *et al*. 2005: www site) allowing them to exist in almost any habitat and indicating their importance in an ecosystem. However, they do need water and, if possible, will always live near this resource (Schweid, 1999: 17).

Cockroaches are considered a pest in most rural and urban areas as they can contaminate food and eating utensils by carrying many human pathogens (Hahn *et al*. 2005: www site). In many cultures cockroaches are a food source and are often considered a delicacy. They are also used in traditional medicine. Indigenous Australians who consumed these insects believed them to have anaesthetic properties (Copeland, 2003: 81). Understanding the behaviour of cockroaches allows controls, such as insecticides, to be improved, while increased understanding may also give insight into how they became to have such large roles in traditional cultures.

'*Social behaviour is a term used to describe the social interactions between members of a species, and is quite common in the cockroach'* (O'Neil *et al*. 1987: 313). Cockroach species are usually described as social, sub social or seldom solitary (Bell

et al. 2007: 131). A female brooding her offspring for several hours before they hatch is considered a sub social interaction and therefore very few cockroach species are considered solitary (Bell *et al*. 2007: 132). There are two categories when cockroaches are social, cohort aggregations and affiliative aggregations (Bell *et al*. 2007: 133). Cohort aggregations are groups of nymphs that do not disperse after hatching and affiliative aggregations are multigenerational groups that may include all developmental stages and both sexes (Bell *et al*. 2007: 133). They involve newly hatched nymphs and those that immigrate from other aggregates (Bell *et al*. 2007: 133). The social structure of the cockroach population is influenced by a number of factors including age, sex, environmental conditions, physiological state, genetics, geographical region, population density, and harborage characteristics (Bell *et al*. 2007: 131). The sizes of cockroach aggregates are ultimately controlled by the resources in the habitat, either by the abundance of food and water or the surface area of undisturbed dark shelter (Bell *et al*. 2007: 134). In different stages of their lifestyle some species of cockroach prefer to aggregate in different locations, for example, inside a hollow tree, whereas younger nymphs prefer to aggregate in areas like leaf litter (Bell *et al*. 2007: 134). Cockroaches actively seek dark, humid, enclosed spaces as shelter, and live in close association with nutritional resources (Bell *et al*. 2007: 132). The size, texture and orientation of the harborage (Bell *et al*. 2007: 135) also influences their instinctive response to the area.

Pheromones are the main chemicals that aid in the social behaviour of cockroaches, and the one that brings them together to form groups is called the 'aggregation pheromone' (Schweid, 1999: 67). It is believed to originate in the rectal pads and is applied to the faecal material within a thin membrane that coats the material as it is being secreted (Bell *et al*. 2007: 135). The pheromone is then released slowly over a long period of time. These chemicals act as short range attractants (Bell *et al*. 2007: 136) and the likelihood of the cockroach's locomotion ceasing upon reaching the source of the pheromone is enhanced with the presence of an actual cockroach (Bell *et al*. 2007: 136). The antennae of the cockroach contain the receptors for these chemical signals (Schweid, 1997: 71) and are covered with cilia, connected by a nerve to a part of the brain that receives signals (Schweid, 1999: 32).

However, cockroaches can form groups because of other stimuli including visual, acoustic, tactile and olfactory stimuli (Bell *et al*. 2007: 136). Environmental factors such as light, temperature, air movement and humidity affect a cockroach's ability to form a group (Bell *et al*. 2007: 136). These factors cause a response from the cockroach resulting in it residing in a particular harborage and by covering the harborage in its bodily secretions containing the pheromone, enhances the chance of other cockroaches residing with it (Bell *et al*. 2007: 137). This is a positive feedback mechanism because as the size of the group increases so does the amount of the pheromone produced and therefore the amount of cockroaches attracted to the area.

Cockroaches form aggregations for many reasons, including aiding in defence and nourishment. By forming groups it allows cockroaches the advantage of safety in numbers, as members react to the evasive movements of the first cockroach that senses the predator (Bell *et al*. 2007: 138). They may also produce alarm pheromones which result in the rapid scattering of the group members creating confusion for the predator which may now struggle to concentrate on an individual insect (Bell *et al*. 2007: 138). There are also nutritional benefits; nymphs develop better when in the presence of groups as food that is broken down by large adult insects is easier for the nymphs to digest, helping them to move quickly through the most vulnerable stages of their lifecycle (Bell *et al*. 2007: 139). Also, anything produced by cockroaches can be consumed by other cockroaches and provides large amounts of nitrogen for the consumer, especially recently shed exoskeletons (Bell *et al*. 2007: 139). By aggregating, the cockroaches also have a higher chance of finding a mate (Bell *et al*. 2007: 139), however, if these are family groups, finding a mate within the group could have negative effects as this causes lack of diversity, and could reduce the cockroaches' chances of survival.

There are also disadvantages of forming groups including an increase in density-dependent factors such as competition for food, water, shelter, mates, density based infectious diseases and parasites and predation (Bell *et al*. 2007: 137). As a result this also increases the chance of cannibalism (Bell *et al*. 2007: 141). They also intensify cues such as olfactory signals that lead predators to their prey (Bell *et al*. 2007: 137). The habitat will also decay at a faster rate and overcrowding causes many physiological problems like prolonged nymphal stages, and decreased body size in the specific insects (Bell *et al.* 2007: 141). Therefore cockroaches have dispersal pheromones which counteract the aggregation pheromones which attract the cockroaches (Bell *et al.* 2007: 141).

While much knowledge is obtainable about cockroaches as a group of insects, particularly ones that are regarded as pests, little is known about *Laxta granicollis*, which is native to Australia.

The social behaviour of these cockroaches will be studied to attempt to decide whether they are solitary, social or sub social. Therefore the research question for this essay is:

Does the *Laxta granicollis,* Australian native cockroach, express social behaviour and can therefore be considered a social organism?

Juvenile *Laxta granicollis* with immature adults

This will be investigated firstly, through observing their initial preference of harborages when placed in a new habitat (Behavioural Study One) and then, through examining their movements for two weeks after being placed in a new environment (Behavioural Study Two). Due to the theory that cockroaches present social behaviour more commonly in laboratories than they would in wild situations (Bell *et al*. 2007: 134), field observations will also be considered.

Notably, the cockroaches moulted and produced offspring while being kept in captivity over the course of the investigation giving proof that the cockroaches were under limited stress, complying with the *International Baccalaureate Animal Experimentation Policy.* A cockroach under stress will result in prolonged nymphal stages and therefore will not moult (Schwied, 1997: 70). The identification of the cockroaches personally used in this observational investigation was confirmed to be *Laxta granicollis* by entomologists at the *Melbourne Museum.*

Determining Sex

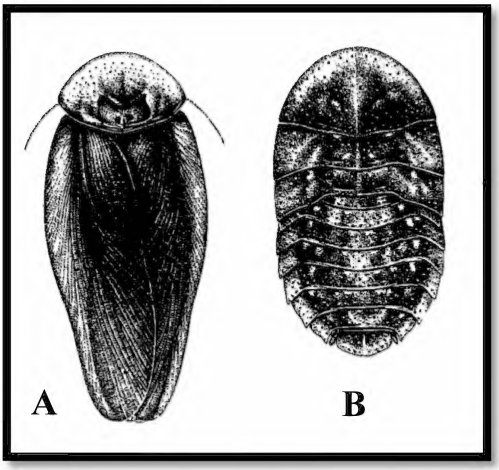

Diagram 1
A – Male (♂) *Laxta granicollis*
B – Female (♀) *Laxta granicollis*
Source: Roth, L.M. 1991, *The Insects of Australia,* Volume 1, Second Edition, Melbourne University Publishing, Melbourne, p.329

Laxta granicollis males have wings only when fully mature. When immature, the males are tapered towards the rear of the abdomen, and on very close inspection, have undeveloped wing 'buds' on the first two segments of the abdomen, after the head; and have a much more flattened final segment of the abdomen compared with the female. The females are wingless and are more round or oval in shape. These identifying parameters were suggested by naturalists at the Australian Museum.

Observations

As it has been found in previous experiments that cockroaches appear to be more social in laboratory conditions than in the wild (Bell *et al*. 2007: 132), the field observations must be considered upon deciding whether this species of cockroach, *Laxta granicollis,* is social, sub social, or solitary.

When the cockroaches were collected from the field, they were found in groups of different sizes ranging from two to seven members in different stages of maturity. Rarely were there any cockroaches found alone. Later in the studies, more

cockroaches were needed and two fully winged mature males were found together with females. This showed that as well as being social, even fully mature males seem to be included in the group.

In the time that the cockroaches were kept in captivity quite a few of the cockroaches moulted including one male, which moulted into a fully winged mature male.

While in captivity it became obvious that the cockroaches resided more commonly on specific pieces of bark than others. When completing husbandry actions it was observed that they were found close to each other, leaving other pieces of bark completely uninhabited. The cockroaches were also observed to have offspring and, when they were first found, they were all beneath one female cockroach. Although this cockroach would be assumed to be an r-strategist, this is an example of maternal care, behaviour quite common in the cockroach.

The exoskeleton of a male *Laxta granicollis* (left) can be seen with the mature insect (right).

Preliminary observational studies, involving filming the cockroaches individually to investigate their circadian rhythm found them to be nocturnal. This was concluded as the cockroaches did not emerge until approximately an hour after dusk. This was however only for short periods of time, usually of no more than 10 to 15 minutes, before returning to the harborage, and only emerging again for a few minutes to investigate the rest of the plastic container in which they were contained.

To be continued

Photos Michelle Clark

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Australian Lynx Spiders... *please don't let them be misunderstood.* – *Robert Whyte*

What do you know about Australian spiders?

Do you think of them as big, hairy, creepy-crawlies? Do they scare you?

If not, you're in the minority. Australians seem to be the most phobic nation on earth, scared literally witless by our arachnid fauna, often trumpeted as 'the world's most deadly'.

Yes, Australian spiders have a bad rep – most of it unearned. Because of a few encounters with wandering, sex-crazed male funnel web spiders – on the hunt for

females in the midsummer rains and sometimes wandering into homes – all spiders often get lumped into the 'too scary' basket. Even funnel webs won't hurt you unless you provoke them.

Most spiders, though, are tiny, intricately arranged and very pretty – thriving in parks and gardens in their millions, catching insects. Without these helpful predators we would have all drowned in insects long ago.

One spider family strangely overlooked in Australia is Oxyopidae – the Lynx Spiders. They are possibly the most common spiders in Australia, yet they are virtually unknown. There are only 19 species known across our continent, possibly a tenth of the number of species really out there.

Most of the known ones were described in the late 1800s by Ludwig Koch. Since then, almost nothing has been published. Fortunately some work was done around 1989-1991 by Judy Grimshaw, a review of the family done for her M. Sc. thesis, copies being held in the University of Queensland Library.

Lynx spiders have six of their 8 eyes making a characteristic hexagonal pattern; and have long, slender, spiky legs (*oxy* means spiky and *pes* means legs). Leaving out the obscure or difficult ones, there are six or seven very obvious Lynx spiders you can find in a few minutes outside without really trying.

In the north, there is a large yellow one called *Oxyopes papuanus*. It's a relative giant, getting to over a centimeter in body length and common across tropical Australia.

The most-often-noticed Lynx is probably the long and lean *Oxyopes macilentus*. The species name means 'thin". It is sometimes bright orange and has attractive go-faster stripes down its sides.

Next most common and widespread are two species hard to tell apart. *Oxyopes elegans* the Elegant Lynx Spider and *Oxyopes gracilipes* the Graceful Lynx Spider are almost identical, about the same size and similarly patterned. The stripes or bands down the sides of the head of the Graceful Lynx Spider are wider than those of the Elegant Lynx Spider.

Easier to tell apart from all others is *Oxyopes variabilis*, the Variable Lynx Spider. It comes in a staggeringly diverse array of shapes and patterns, but all have a pale V shape behind the eyes on the top of the head.

Last but not least is the frisky little *Oxyopes gratus* the Grateful Lynx Spider, with prominent stripes, but only about 4mm in body length.

Oh, one more for good luck. If you are very lucky you might see the beautiful *Oxyopes rubicundus*, the Red Lynx Spider, around Sydney.

Oxyopes macilentus, Thin Lynx Spider
Photo Ed Nieuwenhuys

Oxyopes variabilis, Variable Lynx Spider

Oxyopes rubicundus, Red Lynx Spider
Photo Ed Nieuwenhuys

Oxyopes variabilis, Variable Lynx Spider

Oxyopes papuanus, Papuan Lynx Spider

Oxyopes gracilipes, Graceful Lynx Spider

Oxyopes elegans, Elegant Lynx Spider

Oxyopes gratus, Grateful Lynx Spider

Oxyopes gracilipes, Graceful Lynx Spider

Oxyopes macilentus, Thin Lynx Spider

Now it's your turn. How many of you have a digital camera? Everyone? Good. Do you ever take close-up photos or have you wanted to try? Yes? Excellent! Okay, this weekend, I want you to go out with your camera, put it on the macro setting and see if you can photograph a lynx spider. You'll have to slow down, look closely and be patient. But you are almost certain to find a lynx spider on some plants in your garden, or in a park. You may find a new species. What are you waiting for? Get snapping!

Photos Robert Whyte except where already acknowledged

How many pixels do you really need? – *Malcolm Tattersall*

Insect photography is wildlife photography featuring subjects which are often too small and/or too far away to really 'fill the frame' of our shots unless we have highly specialised equipment. The good news is that we can very often solve that problem by simple editing.

The basic size measurement of digital images is the pixel – one dot, on either the camera sensor, the computer screen or the hard-copy print – and modern digital cameras generate far more of them than we usually need. A current DSLR with an 18MP sensor produces an image 5200 px wide and my four-year-old entry-level DSLR (10 MP) gave me an image nearly 4000 px wide. Current offerings in the point-and-click category are comparable, mostly 12 or 16MP, and even a six-year-old example with its 7MP sensor gives us a 3000 px image.

On the other hand, a typical computer screen is only 1280 – 1600 px wide and a postcard size best-quality print or magazine illustration at 300 dpi (dots per inch) will be 1800 – 2100 px wide. An image much smaller than the camera generates is therefore perfectly adequate for most purposes, and if the subject is a mere dot in the middle of the original we can simply crop the image – drastically, if necessary. Any basic image editing software will do the job; just remember to avoid losing quality by saving and re-saving jpegs.

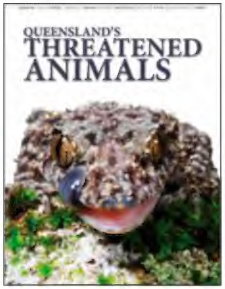
Example 1: This Zodiac Moth, *Alcides metaurus*, was high in my poplar gum and even with my 70-300mm telephoto lens it was the aforesaid dot in the middle of the picture, 550px wide in an image 3888px wide; but it makes a satisfactory shot when cropped to 1080px wide.

Example 2: This mid-sized brown butterfly (probably a Blue Pansy (*Junonia orithya wallacei*) was flitting around a temple garden in Vientiane and the only lens I had with me was a 15-85mm normal zoom. Uncropped, I have a picture of the flowers and the temple wall; at 900px I have a picture of the butterfly.

My examples were both taken with a 10MP camera. Cropping an 18MP image to the same extent would have given me images 1400 and 1200px wide respectively. 1400px is big enough for a full-width photo in this magazine (even if it is printed at 300dpi, i.e. glossy-magazine quality) and even 900px is plenty big enough for a half-page-width photo.

That said, editors normally appreciate larger images because that gives them more choice in how to crop them and how big to print them. The bottom line, then, is that if you want your work to appear in *Metamorphosis* (and you do, don't you?), you don't need to worry too much about image size. Just submit your best and biggest images and don't hold back for fear your camera isn't good enough or the butterfly was too far away. Photos Malcolm Tattersall

BOOK REPORT



Queensland's Threatened Animals

Eds: L K Curtis, A J Dennis, K R McDonald, P M Kyne and S J S Debus

Feb 2012, CSIRO Publishing - *Reviewed by John T. Moss*

As the publisher says, this 472 page comprehensive guide features "up-to-date distribution data, photos and maps for most of Queensland's threatened animals", in a quality paperback format. Although the main focus is on the better known vertebrates, there is a small section that focuses on the lesser known invertebrates which includes insects, crustacea and molluscs. I make no apologies for focussing comments herein mostly on my interest area of insects!

The **editorial panel** are experienced and respected authors, biologists, ecologists and conservation managers and include Lee Curtis, contributor and correspondent for *Wildlife Australia Magazine* as well as being a member of our BOIC! The **contributing authors** and reviewers are knowledgeable, professional and lay experts, known to be competent in their field. They include (for the insects) the well-known authorities Dr D P A (Don) Sands, Dr Gunther Theischinger, E D (Ted) Edwards, Peter Valentine and Steven Johnson.

Contents include: the **definition** of a threatened species and a list of threat categories, called **conservation status**, including the differentiation of the often confused words **threatened** and **endangered** (i.e. class vs. category!); the processes of **listing** and **delisting**; a history of threatened species **recovery** and **management** in Queensland; and, of course, individual **species profiles** which include one moth, two dragonflies, six butterflies, ten crabs and crayfish and twenty snails!

It is pleasing to see that the editors have included, as well as specific animals, the definition and examples of **threatened ecosystems.**

There is also an already **extinct** list but this does not include invertebrates that are presumed extinct but because of deficiencies in census/survey they would be best categorised as **data deficient.** A good example of this is the Australian or Laced Fritillary butterfly (*Argynnis hyperbius inconstans*), which is included under "endangered" but lacks the specific information that it was last collected in 1987 and has not been reliably seen in Queensland since 1994! In relation to this butterfly, there have been many fruitless surveys in recent years, in particular following a hoax sighting in 2008! The negative findings of these surveys, although well known amongst the butterfly enthusiast community, have not as yet been published, which is presumably why the authors have not included them. Thus this census omission calls into question the currency and validity of this species' data for the book! However, to their credit, they did not include several false or dubious sightings from the last two decades!

Within the species profiles the relevant information is discussed under the headings: conservation status, description, distribution, habitat, ecology, reasons for decline, current threats, current recovery efforts, future recovery actions and sources and further reading.

The book also includes a comprehensive list of resources; with key state, national and international organisations involved in the recovery and management of Queensland's threatened species and ecosystems. These conservation agencies include the Queensland Government's Threatened Species Network and in concert with local authorities, the Land for Wildlife program (jointly funded by federal, state and private sources). In the case of the butterflies, specific mention is made of the 2002 Action Plan for Australian Butterflies, Richmond Birdwing Conservation Network and the Butterfly and other Invertebrates Club as being involved with action/recovery plans.

It is pertinent to quote from the introduction to the Lepidoptera section: "The task of completing a systematic survey is challenging and very few species have been subjected to any attempt, even in local areas. Much of the current information on butterfly and moth conservation status relies on the casual observations and anecdotal accounts of field scientists and hobbyists. Substantial knowledge regarding moth distribution and biology would be necessary to be able to determine accurately which species are threatened and which are not. Unfortunately, only a few species have been studied sufficiently. It is highly likely that many moths have become extinct over the years due to human activities, but this happened prior to them being described and named."

The authors identify important causality factors of lack of taxonomic staff, students and biodiversity studies as critical areas as a result of government underfunding. Furthermore, they somewhat gloomily state that "it is usually at the end point of a species conservation decline before surveys are commenced" and that "these may do little more than document extinction!" On a more practical and realistic note, is their final comment that "habitat conservation is the essential priority and conservation agencies can be most effective if they combine knowledge of habitat requirements with programs of habitat protection". This has obvious application for multiple species and of course, flagship species, such as the Richmond Birdwing butterfly, have a pivotal role to play.

The editors and authors are to be congratulated on a comprehensive, mostly accurate and timely publication, which clearly sets out threatened species current known or presumed status, defines the problems in conservation issues and recommends both specific and general solutions, not only for Queensland but for the nation as a whole!

In conclusion I can only recommend this beautifully designed book with a plethora of important information, including distribution maps and species illustrations, useful for both reference and proposed actions. It is very good value at $129 posted, from the publishers: CSIRO Publishing, at PO Box 1139, Collingwood, Victoria, 3066. It is also available as an eBook via the CSIRO website (www.publish.csiro.au/eBooks). To keep the publication current, both options will be complemented by an open access website, which will be updated on a regular basis as new information comes to hand.

REPORTS

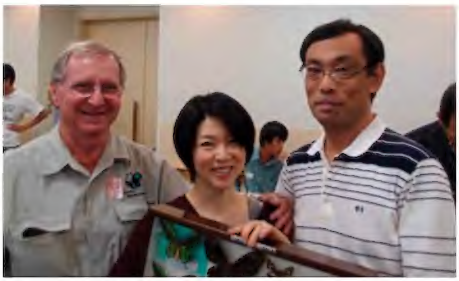
A Visit to Japan - *Ross Kendall*

In late September and early October, we experienced two weeks of wonderful Japanese hospitality. To an Australian, the population density is an eye opener. The transport system is very efficient and the people are very courteous, generous and tidy (no litter!).

The countryside was lush and green with just the hint of autumn colours in the mountain areas. I observed quite a number of species of butterflies, even in urban areas with the local Fritillary quite common.

On September 23rd, I attended the Ohtemachi Insect Fair in Tokyo as a guest of Club member Makoto Nakae. This one-day fair is held annually and is the world's largest insect fair. 240 exhibitors displayed their wares from around the world and 1800 people attended. There were some enthusiasts who came from Europe and North America – just for the weekend.

Very few Australian insects were to be seen and the consensus from collectors is that Australian regulations discourage the removal of specimens from Australia. I managed to find two cases of Australian butterflies as evidenced below.



Self, Reiko Miyamoto and Makoto Nakae

Yuri Shibata, self and Reiko Miyamoto

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Trivia Night – *Jennifer Singfield*

On the evening of the 6th October 2012, forty-five intrepid souls attended the inaugural BOIC Trivia evening at IndigiScapes. The questions had been organised and delivered in an entertaining fashion by Jill Barrett with Helen Magarry and Ruth Taylor being the very efficient judges. The evening was well supported by BOIC members attending, providing prizes and assisting with the evening's smooth running. The aims of the event were to raise funds to contribute to the continued publication of *Metamorphosis* and to provide a social event for BOIC's members. The event proved positive for both aims and there was a real buzz in the air as the questions kept on coming.

BOIC wishes to thank Manly West Chemmart Pharmacy, Manson Framers, Wynnum, Dr Deb Mills, The Travel Doctor and Helen Schwencke, Earthling Enterprises for their donations for the Multi-Draw raffle. Lois donated a wonderful dragonfly print, Alisha donated the wines for first and second prizes and Daphne worked tirelessly behind the scenes organising prizes and catering.

Due to the success of the evening, both socially and as a fund-raiser, we have bravely decided to hold another Trivia evening on Saturday 20th April 2013. (Bookings jennifer@mbcc.org.au or phone 3869 0359).

LETTERS

Photo Hilton Selvey

The oval eggs are those of a tachinid fly. They are stuck on with more astonishing glue than even the butterflies can produce. I found that it was impossible to remove any eggs from these larvae - trying to pull them off merely disrupted the cuticle removing green haemocoel.

If I had left the eggs in place I doubt if the larvae of the tachinid fly would have had enough tucker before the Monarch larva was cleaned out. *Hilton Selvey*

YOU ASKED

Could you identify these beetles please? I photographed them in my garden at Talegalla, south of Minden, Queensland on 20 October 2012.

Mick Drew

The species is *Chauliognathus flavipennis* (Macleay, 1872) and it belongs to the family Cantharidae, commonly known as Soldier Beetles. The species is widespread up and down the eastern coast of Australia and goes quite a way inland. Soldier beetles are independently toxic and exude toxic fluid, when disturbed, from paired glands on thorax and abdomen. Members of the family are known to have that characteristic all round the world. This particular species combines its warning colours with the yellow and black banding which is the universal "wasp...don't touch me" signal among many groups of toxic insects. They are mimiced by a range of other

insects which share the yellow and black colour patterns, including various buprestid and longicorn beetles. They do not particularly mimic lycid beetles which almost all have a dark orange or orange and black colour pattern, rather than yellow and black, and the lycids rarely reinforce their warning with the chequered "wasp" signal. There are a number of species of *Chauliognathus* which have very similar colour patterns to *C. flavipennis* and this group could be regarded as being a Batesian mimicry complex sharing the same signals with other toxic or "stinging" species. But the lycids are not part of this mimicry complex because they have different colours.

Geoff Monteith

****

On various occasions, I have been asked to identify eggs and caterpillars found on citrus leaves. Last summer, I persuaded three "amigos" to pose on a leaf of a Meyer Lemon and the result is shown below. *Ross Kendall*

From left to right we have: a Dainty Swallowtail (*Papilio anactus*), a Fuscous Swallowtail (*Papilio fuscus capaneus*) and an Orchard Swallowtail (*Papilio aegeus aegeus*).

In later instars, the three species (in the same order) are quite different as seen below.

If we go back to the beginning, from left to right we have the eggs of Fuscous, Dainty and Orchard Swallowtails.

Occasionally, Chequered Swallowtails (*Papilio demoleus sthenelus*) breed on Citrus species. While their eggs are similar in size to Fuscous eggs, larvae and pupae are quite different as seen, following, on Emu's foot (*Cullen tenax*).




The following pupae are: Dainty Swallowtail, Fuscous Swallowtail, Orchard Swallowtail and Chequered Swallowtail.




Photos Ross Kendall

These photographs were taken by Phillip Ochse.

Vanessa Itea
(Yellow Admiral)

Papilio demoleus sthenelus (Chequered Swallowtail)

Delias nigrina (Black or Common Jezebel)

Catopsilia pomona pomona (Lemon Migrant)

Other Groups' Activities

Redlands 'Awesome, Awful and Endangered', a photographic exhibition at Redlands IndigiScapes Centre, 17 Runnymede Road, Capalaba, Qld., was successfully launched on the 3rd November, supported by the Redland City Council.

It is the result of over 25 photographic workshops conducted by Julie Geldard, capturing images of awesome birdlife, wildlife, the tiny world of macro life, wildflowers, landscapes, seascapes, reptiles and butterflies.

Julie says "This project has brought home to me just how absolutely awesome the Redlands is. After 20 years of photography I feel this project has made my years of learning worthwhile, which is to share and increase other's awareness of the wonders of nature in the Redlands." Check out http://www.facebook.com/groups/252002504903009/ for images from the group.

Redlands wildlife will all celebrate your help and commitment to make changes, share awareness, and support conservation groups. Profit from the sales of the indoor metallic prints, garden stake images and hanging garden images are all being donated to conservation groups, BOIC being one such recipient. The exhibition runs for 10 weeks.

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Woodfordia's Butterfly Project - join the regular working bee at Woodfordia, every last Sunday February to November from 8.30am, in conjunction with the TreeHuggers. The project works to enhance the Festival site for biodiversity, especially butterflies and other invertebrates. Contact Helen: butterflies@woodfordia.com or phone 0423 127 492

Butterfly and Other Invertebrates Club Programme

Planning Meeting – 9th February, 2013

Day trip to Ray and Delphine Archer's bird and butterfly sanctuary, Buaraba with free macro photography lessons by Phil Ochse

What: Six years ago Ray and Delphine set about transforming their property into a wildlife haven for birds, insects and frogs. They have planted thousands of trees, shrubs, herbs and vines and the wildlife has come. The latest section is the butterfly meadow with lots of flowers and host plants. Feel free to capture as many creatures as possible – on film.

When: Sunday 24th February 2013 from 10 am.

Where: Bischoffs Road, Buaraba. Enter this road off the Gatton-Esk Road. If you would like a map, please contact Daphne for a copy.

Bring: Your camera, hat, food and drink for lunch in the garden.

While **RSVP** is not essential you may like to phone Ross on 0402 254 370 or Ray on 0409 491 419.

Disclaimer

The magazine seeks to be as scientifically accurate as possible but the views, opinions and observations expressed are those of the authors. The magazine is a platform for people, both amateur and professional, to express their views and observations about invertebrates. These are not necessarily those of the BOIC. The manuscripts are submitted for comment to entomologists or people working in the area of the topic being discussed. If inaccuracies have inadvertently occurred and are brought to our attention we will seek to correct them in future editions. The Editor reserves the right to refuse to print any matter which is unsuitable, inappropriate or objectionable and to make nomenclature changes as appropriate.

Acknowledgments

Producing this magazine is done with the efforts of:

- Those members who have sent in letters and articles
- Lois Hughes who provided the cover painting
- Daphne Bowden who works on layout, production and distribution
- John Moss, Dr. Christine Lambkin, Dr. Sarah Mansfield and Martyn Robinson for scientific referencing and proof reading of various articles in this issue of the magazine
- Printing of this publication is proudly supported by Brisbane City Council

We would like to thank all these people for their contribution.

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Butterfly and Other Invertebrates Club Inc.
PO Box 2113
RUNCORN Q. 4113

Next event - Sunday 24th February 2013 – see programme for details